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U. S. DEPARTMENT OF AGRICULTURE,

BUREAU OF SOILS—MILTON WHITNEY, Chief.

SOIL SURVEY OF GENESEE COUNTY, MICHIGAN.

BY

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[Advance Sheets—Field Operations of the Bureau of Soils, 1912.]

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LETTER OF TRANSMITTAL.

UNITED STATES DEPARTMENT OF AGRICULTURE,
BUREAU OF SOILS,
Washington, D. C., July 22, 1913.

SIR: In the extension of soil-survey work in the State of Michigan, work was undertaken in Genesee County during the field season of 1912.

I have the honor to transmit herewith the manuscript report and map covering this work, and to request their publication as advance sheets of field operations of the Bureau of Soils for 1912, as authorized by law.

Very respectfully,

MILTON WHITNEY,
Chief of Bureau.

Hon. D. F. HOUSTON,
Secretary of Agriculture.

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MAP.

Soil map, Genesee County sheet, Michigan.

SOIL SURVEY OF GENESEE COUNTY, MICHIGAN.

By B. D. GILBERT.

DESCRIPTION OF THE AREA.

Genesee County is located a little southeast of the geographical center of the lower peninsula of Michigan. It is bounded on the

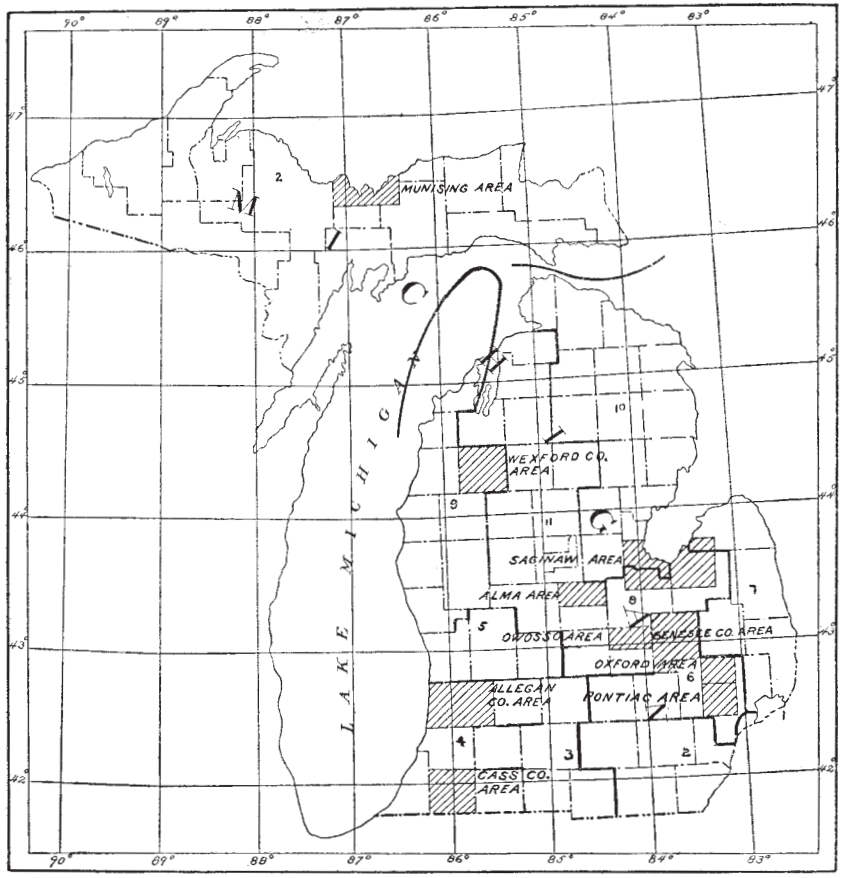

FIG. 1.—Sketch map showing areas surveyed in Michigan.

north by Saginaw and Tuscola Counties, on the east by Lapeer and Oakland Counties, on the south by Oakland and Livingston Counties, and on the west by Saginaw and Shiawassee Counties. The extreme dimensions of the county are 30 miles north and south by

24 miles east and west, the total area being 655 square miles, or 419,200 acres, including water surface. The county lies at a comparatively low altitude and shows no great range in elevation, the greatest difference being approximately 225 feet. The highest point in the county is about 950 feet above sea level on the county line near Fenton.

The northwestern part of Genesee County is contained in the bed of old Lake Saginaw and is a level plain broken only by the rather abrupt channels cut into it through unconsolidated material by the Flint River and its tributaries. Nowhere in the county does the bedrock outcrop, it being covered to a depth of many feet by glacial till or material of lake or stream deposition. The boundary between this plain and the upland is intermittently and obscurely marked by remnants of the old Lake Saginaw beach line.

The greater part of Genesee County consists of undulating to rolling till plains, the general level being broken only by the long, low, even swells of the moraines. There are no particularly conspicuous surface features. In the northeastern and southernmost parts of the county the topography is broken to comparatively rough and hilly.

All the drainage of Genesee County finds its way eventually through the Flint and Shiawassee Rivers and their tributaries into Lake Huron, and thus into the Great Lakes-St. Lawrence system. The principal stream is the Flint River, which follows a southwesterly course from a point about 7 miles south of the northwest corner to about the middle of the county, thence in a northwesterly direction across the northern boundary about 3 miles from the northwestern corner. Nearly 40 miles of its course is within Genesee County, and it and its tributaries drain about 550 square miles of the area. The Shiawassee River, which flows in a westerly direction through the two southernmost townships, takes care of the drainage of that part of the county.

Numerous small lakes, many of them having no outlets, occur throughout the upland portion of the county. Chief among these is Long Lake, situated in Fenton Township. Others of some importance are Mud, Silver, Loon, Pine, Byram, and Lobdell Lakes. A deposit of marl in Mud and Silver Lakes is dredged and used in the manufacture of cement.

Genesee County was erected from parts of Shiawassee, Lapeer, and Saginaw Counties in 1835. It was named for Genesee County, N. Y., whence many of the settlers came. In fact nearly all the early settlers in this part of Michigan were from that State. The county seat was located at Flint, which became an incorporated city in 1855 and now has a population of about 40,000.

The first road across Genesee County was the Grand Traverse, now known as the Saginaw road, which followed an Indian trail from Detroit to Saginaw. It was along this road that settlement was first accomplished. For several years this was the main route of travel into and through the county, and it was by this route that products of the early farming were hauled out. A wooden tramway was built about 1835 from Detroit to Royal Oak and later extended to Pontiac. A steam road was soon built over the same route, but it was not until 1863 that the Flint & Pere Marquette Railroad was projected through Flint. At present the Pere Marquette Railroad traverses the county from north to south and the Grand Trunk from east to west. The Detroit, Grand Haven & Milwaukee Division of the Grand Trunk system extends across the southern part and the Cincinnati, Saginaw & Mackinaw Division of the same system across the northwestern part of the county. The Flint & Fostoria Branch of the Pere Marquette reaches the extreme northeastern part of the county. Besides these an electric line, the Detroit United Railroad, extends through the county from north to south and reaches points in the southeastern part. Thus no section of the county is more than 10 miles from a shipping point.

The county highways have been very poor until within a year or two, during which time extensive improvements have been made.

Flint is the principal home market, and a part of the farm products is consumed there, especially truck crops. The markets of Detroit, Chicago, and the cities of northern Indiana and Ohio are accessible. The chief products shipped to other parts of Michigan and to other States are hay and wheat.

CLIMATE.

The summers in this part of Michigan are short and the winters long, though not unusually severe. The Great Lakes are too remote from Genesee County to modify the climate to any extent, and it is often marked by sudden changes and violent extremes. The range in temperature between the extremes of summer and winter is great. During the year from November, 1911, to October, 1912, the highest temperature recorded was 93° F., in July, and the lowest —26° F., in February. The average annual temperature is about 44° F.

The dates of the last killing frost in spring range from April 28 to May 21 and of the first in the fall from September 21 to October 26. The longest growing season reported for the 10 years from 1902 to 1912 is 173 days and the shortest 133 days.

The average total precipitation at Flint is about 28 inches and the average total amount of snowfall about 40 inches.

The data given in the following tables are taken from the Weather Bureau records of the station at Flint:

Normal monthly, seasonal, and annual temperature amd precipitation at Flint, Mich.

Month.	Temperature.			Precipitation.		
	Mean.	Absolute maximum.	Absolute minimum.	Mean.	Amount snow-fall.	Average depth of snow.
	°F.	°F.	°F.	*Inches.*	*Inches.*	*Inches.*
December	32.4	55	9	1.80	6	1
January	10.5	37	−16	1.78	5	4.7
February	15.2	44	−26	1.43	12	7.2
Winter	19.3	.....	.....	5.01	23	.....
March	24	51	−1	1.97	14	5.3
April	43	73	22	2.14	.....	Trace
May	56.2	86	33	3.80	.....	.....
Spring	41	.....	.....	7.91	14	.....
June	62.1	90	42	2.83	.....	.....
July	71.8	93	42	2.77	.....	.....
August	65.5	87	41	2.58	.....	.....
Summer	66.4	.....	.....	8.18	.....	.....
September	64.2	92	35	2.66	.....	.....
October	50.9	79	29	2.12	.....	.....
November	34.7	67	13	2.35	2.5	Trace.
Fall	49.9	.....	.....	7.13	2.5	.....
Year	44.1	93	−26	28.23	39.5	.....

Dates of first and last killing frosts at Flint.

Year.	Last in spring.	First in fall.	Year.	Last in spring.	First in fall.
1902	May 15	Oct. 10	1908	May 5	Oct. 3
1903	May 4	Sept. 29	1909	May 4	Oct. 12
1904	May 11	Sept. 21	1910	May 15	Oct. 26
1905	May 1	Oct. 21	1911	May 5	Oct. 8
1906	May 9	Oct. 10	1912	Apr. 28	Oct. 16
1907	May 21	Oct. 1			

AGRICULTURE.

For many years following the settlement of Genesee County, agriculture held a secondary position. Development was necessarily slow because of the heavy forest which covered the land. Lumbering early became an important industry and flourished while the

thick forests of oak, hickory, and pine lasted. Because of the proximity of material Flint became a carriage-manufacturing center.

Wheat and corn were the principal crops grown by the early settlers, and wheat continued to be the most important money crop until recently. The leading crops of the county, in the order of their present importance, are corn, oats, wheat, potatoes, hay, sugar beets, and beans. Other less important crops are barley, rye, buckwheat, cabbage, and the smaller truck crops. On the lighter soils a considerable acreage is devoted to growing strawberries and other small fruits.

Corn is usually grown on sod land, which is most often broken in the spring. What manure is made on the farms is usually spread on the grass land intended for corn, and ordinarily no commercial fertilizer is used. The average yield of corn per acre for the county varies from 30 to 40 bushels in different seasons. Yields of 50 to 130 bushels per acre have been reported for the Miami loam, which is undoubtedly the best corn soil in Genesee County. Yields of corn on the Miami clay loam are generally lower, though in favorable seasons yields as high as 75 bushels per acre are obtained. Other soils give yields ranging from 25 to 45 bushels per acre.

The acreage in oats usually exceeds that in corn. With few exceptions this crop follows corn in the rotation. A small amount of commercial fertilizer is sometimes used on the oat crop. A common practice is to seed the field to clover and timothy with the oats, using the grain drill. The crop is cut in July with the harvester, and the grain is cured in shocks in the field. The Miami loam and Miami clay loam give the best yields—from 30 to 75 bushels per acre. The average yield of oats for all the soils of the county is about 30 bushels per acre.

Winter wheat was formerly the staple money crop of the county, but not so much wheat is grown at the present time. It is still, however, an important crop, and is grown to some extent on practically all the farms. The census figures for 40 years show a decrease, both in the number of acres sown to wheat and in the average yield per acre. The largest yields, from 25 to 40 bushels per acre, are obtained on the Miami clay loam and Miami loam. Other soils yield from 10 to 30 bushels per acre, the average for all the soils of the county being between 18 and 20 bushels per acre.

The usual practice is to plow the oat stubble in August or early in September and drill in the wheat before the middle of September. About 150 to 200 pounds per acre of phosphatic fertilizer is usually drilled in with the seed, which, it is claimed, aids in starting the plant growth and in filling the heads. The grain is bound and cured in shocks in the field. Practically all of the product is shipped out of the county.

The acreage in potatoes is composed of small fields scattered throughout the county, confined to the lighter soil types. This crop is grown commercially in a small way on the Fox and Plainfield soils, the Dunkirk gravelly sandy loam, and on the lighter members of the Miami and Coloma series. The average yield of potatoes on all the soils of the county is less than 100 bushels per acre. Yields as high as 250 bushels of good marketable tubers have been obtained on the Fox and Plainfield soils, and this would seem to indicate that, with good seed, care, and fertilization, the average yield could be doubled and the acreage extended.

Hay constitutes an important crop of Genesee County. Timothy and red clover are sown together, either in the spring with oats or in the fall with wheat. Practically all the soils of the county produce good grass, particularly the heavier members of the Miami series. The Miami soils are rich in lime, which is favorable to the growth of clover. The Coloma soils lack lime, and while they produce good yields of timothy red clover is not successful. The Miami loam and the Miami clay loam yield from 1½ to 3½ tons of mixed hay and from 1 to 2 tons of timothy per acre. The Coloma loam produces an average of about 1¼ tons of hay per acre. The average yield of hay for all the soils of the county is about 1½ tons per acre.

Timothy and clover seed are sown mixed in equal quantities. The clover rarely lasts longer than one year, when the timothy comes on and is allowed to occupy the ground one or two years, or as long as a profitable crop can be cut. No difficulty is had in getting a stand of clover on the Miami soils, except where those soils are poorly drained. Alsike clover is successfully grown on the Coloma loam.

Sugar beets have become an important money crop within the last few years. This crop is especially successful on the Clyde loam, yielding 10 to 20 tons per acre of beets of excellent quality, averaging about 14 tons. The Miami loam also produces good yields of this crop, from 7 to 14 tons per acre of good quality beets being obtained. Large yields of beets are sometimes obtained on the Muck soils, but the product is rather low in sugar content.

The growing of this crop requires a large amount of hand labor in hoeing, weeding, and thinning. The farmer usually makes a contract with a beet-sugar refining company, in which he agrees to plant a specified number of acres of beets, cultivate with horses, and deliver, at a stated price per ton, to the nearest shipping point when the beets are harvested. The sugar-beet company provides the hand labor. The beets are sown early in June and harvested in October or November, before the ground freezes hard. The green beet tops are piled in the field and either pastured or hauled into the barns as stock feed.

Beans have proved a profitable crop and the acreage in this crop has steadily increased since it was introduced, about 1880. Beans are grown on practically all of the soils of the county. The crop is most successful on the Miami, Clyde, and Coloma soils. An average yield of about 20 bushels per acre is obtained on the Miami loam and Miami fine sandy loam in favorable seasons. The Clyde fine sandy loam and Clyde loam produce an average of about 15 bushels per acre, and the Coloma loam a yield somewhat lower. The bean crop is planted in the latter part of May, in hills 18 or 20 inches apart, in rows 3 feet apart, to allow cultivating one way. The crop is harvested in September by means of the bean cutter, piled in small shocks, and allowed to dry in the field. Protracted wet weather at this time is disastrous to the crop, as the beans rust and often sprout.

The number of acres in barley has increased steadily since it was first grown in Genesee County. At the present time the acreage in barley is about one-fifth that in wheat and one-eighth that in oats. The crop succeeds best on the Miami loam, producing yields of 20 to 35 bushels per acre. The average yield of barley for all the soils on which it is grown is between 20 and 25 bushels per acre.

Rye is grown to a considerable extent on the lighter soils of the Fox and Plainfield series and on the light phase of the Miami fine sandy loam. In 1880 there were about 100 acres in rye, and in the present season (1912) there were over 8,000 acres. Rye is occasionally used as a nurse crop when it is decided to seed some of the lighter soils to grass and clover, since it makes less demand on the supply of soil moisture than either wheat or oats. The average yield of the grain per acre is about 15 bushels. The product is mostly shipped out of the county.

Buckwheat is not grown extensively. It is often sown on wet ground or where corn has failed, and is sometimes plowed under as green manure. The acreage in buckwheat has not doubled in 40 years. The most of the product is used in the county.

Cabbage often proves a valuable money crop on Miami loam and on areas of the Clyde soils, especially on the Clyde loam. Cabbage yields from 7 to 15 tons per acre on the latter soil.

Cucumbers and tomatoes are grown to a considerable extent on the Miami loam and Miami fine sandy loam in the vicinity of Flint. Strawberries and the small bush fruits find a ready market in Flint. So also do the lighter truck crops. The success of present growers seems to indicate that the acreage in these crops might well be extended.

Enough alfalfa was seen scattered throughout the county to indicate that this crop would prove valuable on the better drained Miami loam.

As stated before, the Miami loam is rich in lime, a condition which is favorable to the growing of alfalfa. Inoculation would not be necessary to secure a stand of the crop, since sweet clover grows luxuriantly on this soil. In planting a seeding of alfalfa the only difficulty to be met is drainage. To secure the best results the land should generally be tile drained. Care in manuring and preparing the seed bed and in selecting the seed will insure success.

Fruit growing as an industry has never been taken up extensively in Genesee County. A few small orchards are scattered over the county, but not so much attention has been given to fertilizing, cultivating, and spraying as should be to insure success. The gravelly phase of the Miami loam is especially suited to apple orcharding because of good drainage. The steeper slopes within this phase of the type might well be utilized in the growing of grapes.

A common rotation practiced in the county is corn, oats, wheat, and grass; the land remaining in sod as long as a profitable crop can be cut. The general practice is to harvest one crop of clover the first year in sod, one crop of timothy the second year in sod, or the fifth year in the rotation, and then plow the sod land for corn.

Much of the hay is baled and sold instead of being fed to stock on the farm. Some method should be devised for returning more organic matter to the soil, either as stable or green manure, in order to maintain the soils in their present state of productiveness.

Nearly every farm, in addition to the work animals, has a few head of cows, sheep, and hogs. Dairying has recently been taken up and two or three herds of pure-bred Holstein cattle are maintained in the county. A few herds of pure-bred Herefords are also kept. The greater proportion of the dairy and beef animals, however, are grades, either Holstein or Hereford. A common practice is to purchase sheep in the late summer or fall, pasture them on the stubble and aftermath until winter sets in, and then fatten them through the winter. This is a profitable method of disposing of roughage on the farm, the principal profit being derived from the wool, the increased weight of the animals, and the manure.

The value of all live stock in Genesee County in 1880 was $1,794,507, and in 1910 it had increased to $3,267,433, as given in the census for those years. This is not due entirely to increase in the price of stock, but partly to the increase in numbers and to the improvement in breeding.

The labor situation has become somewhat complicated in Genesee County within the last few years, since the manufacturing enterprises of Flint, Detroit, and other cities of Michigan offer so many inducements to the young men of the county. The situation has been

somewhat relieved by the immigration of foreigners. The ordinary wage for farm hands is from $25 to $40 a month.

The total area in farms has increased about 15,230 acres, and the total area improved in farms has increased about 68,240 acres in 30 years (1880 to 1910). The average size of farms increased from 85 acres in 1880 to nearly 100 acres in 1910. Few farms exceed 200 acres in extent, though there are some that contain 300 or 400 acres. The number of farms decreased from 4,379 in 1880 to 3,395 in 1910, which fact accounts in part for the increase in size of farms for the same period. The farms operated by the owners in 1880 numbered 3,876, or 88.6 per cent, while in 1910 the ratio was 76.6 per cent.

The value of all farm land, improvements, and buildings in 1880 was $15,654,955 and in 1910 was $20,682,070, an increase of over $5,000,000. Land values vary considerably, ranging from $15 to $200 or more per acre. The average price for all lands is about $40 an acre, but the best land sells for $100 to $150 an acre, and occasionally as high as $250 an acre, depending on the extent of improvements and location. An occasional farm distant from market and in poor condition can be bought for $25 to $30 an acre.

SOILS.

Twenty-four types of soil and five phases of types are mapped in Genesee County. These are grouped in eight series. In addition to these series there are several miscellaneous soils, Peat, Muck, Meadow, and Dunesand, of less agricultural importance.

These soil types have been largely derived from the weathering and reworking of materials brought in by the glacial ice. The types owe their characteristics to the different processes operating in laying down the materials or since their original deposition. The following forces have been operative: (1) Deposition under and at the borders of the ice sheet; (2) deposition in glacial lakes; (3) deposition by streams in first-bottom and terrace positions; (4) deposition by glacial waters; (5) accumulation of decomposed vegetable matter; and (6) accumulation of windblown materials. By far the greater proportion of the soils have been formed by materials deposited under and at the borders of the ice sheet, including the Miami, Coloma, and Rodman series. The Clyde and Dunkirk soils represent lacustrine deposition of reworked glacial material; the Fox and Genesee series include soils of stream deposition, ancient and modern; and the Plainfield series includes soils deposited by glacial waters flowing from the melting ice.

Of the miscellaneous soils Meadow and Dunesand are largely nonagricultural. All the soils of the more important series are extensively farmed.

The following table gives the names and the actual and relative extent of each of the soils mapped in the county:

Areas of different soils.

Soil.	Acres.	Per cent.	Soil.	Acres.	Per cent.
Miami loam	220,736	56.0	Miami sandy loam	5,440	1.3
Gravelly phase	13,952		Fox fine sand	5,440	1.3
Miami clay loam	30,080	7.2	Genesee loam	4,864	1.2
Miami fine sandy loam	15,680	5.0	Fox fine sandy loam	4,736	1.1
Light phase	5,248		Genesee fine sandy loam	2,688	.6
Fox gravelly sandy loam	20,672	4.9	Fox sandy loam	2,560	.6
Clyde loam	11,008	4.8	Dunkirk fine sand	2,368	.6
Light phase	9,024		Fox sand	2,240	.5
Clyde fine sandy loam	18,048	4.7	Dunkirk gravelly sandy loam	1,280	.3
Coarse phase	1,792		Rodman gravelly sandy loam	1,024	.2
Meadow	11,904	2.8	Clyde clay loam	832	.2
Coloma fine sandy loam	6,336	1.9	Plainfield gravelly sandy loam	768	.2
Light phase	1,472		Dunesand	192	.1
Peat	6,784	1.6			
Coloma loam	6,528	1.6	Total	419,200	
Muck	5,504	1.3			

MIAMI SANDY LOAM.

The soil of the Miami sandy loam is a yellowish-gray to brown sandy loam, varying from 6 to 12 inches in depth, underlain by yellow sandy loam or loamy sand or sand to the depth of 3 feet or more. The underlying heavy till is not often encountered in the 3-foot section. Gravel in varying quantities and sizes nearly always occurs in both soil and subsoil and a scattering of gravel is frequently found on the surface. The subsoil contains a very small proportion of clay, which, however, is sufficient to cause the soil to stand up well in cuts. The soil is usually kept in good tilth with a moderate expenditure of labor, though occasionally it contains sufficient clay to cause it to clod when plowed in a wet condition.

The Miami sandy loam is scattered in comparatively small areas throughout the county. It nowhere occurs in as large tracts as does the Miami fine sandy loam. The soil is composed mainly of glacial drift and occurs most frequently in the form of moraines.

The topography varies from undulating to hilly, and the character of the surface, together with the loose structure of the subsoil, insures excellent though not excessive drainage.

The native vegetation consists of white pine, hemlock, sugar maple, elm, oak, and hickory.

The type is devoted to general farm crops. It is well adapted to the lighter grains and late potatoes. The few apple orchards located on the type indicate that more of it could be profitably devoted to

winter apples. Peaches have been grown to a limited extent in Argentine Township and have given fair returns. It is doubtful, however, if the acreage in peaches should be extended. Corn yields in ordinary seasons from 13 to 30 bushels per acre, with an average of about 20 bushels; wheat, 10 to 25 bushels, averaging 15 bushels; oats, 40 to 70 bushels, averaging 50 bushels; rye, 15 to 25 bushels; beans, 8 to 18 bushels; potatoes, 100 to 200 bushels; and mixed hay, 1 to 2 tons per acre. Buckwheat, not commonly grown, yields from 12 to 20 bushels per acre.

Agricultural conditions on the Miami sandy loam are usually good. The land has a range in value from $40 to $75 an acre, depending on improvements and nearness to markets. When sold in connection with other soils it brings as much as $100 an acre.

As mentioned above, more of this soil should be devoted to orcharding, especially that part with the more uneven topography. More attention should be given to spraying, cultivating, and fertilizing the orchards already established. Deeper plowing and liberal applications of green and stable manures would greatly benefit this soil.

MIAMI FINE SANDY LOAM.

The surface soil of the Miami fine sandy loam, to a depth varying from 6 to 10 inches, is a grayish-brown, light-brown, or brown fine sandy or sandy loam. The upper subsoil to a depth of about 2 feet is a yellowish-gray fine sandy loam, sometimes loose in structure, but usually rather heavy. This is underlain by a somewhat compact loam or heavy loam. There is usually sufficient clay in the soil to cause it to clod when cultivated in too wet a condition, but when properly cultivated it is friable and mellow. A small quantity of gravel is usually present in both soil and subsoil. Besides the slight textural difference, the main difference between the Miami fine sandy loam and the Miami sandy loam lies in the presence of the heavy subsoil within 2 to 4 feet of the surface in the case of the former.

The Miami fine sandy loam occurs in bodies of regular outline scattered throughout Genesee County in tracts ranging in size from those too small to be represented on the map to areas 2 or 3 square miles in extent.

The material composing the type is weathered glacial till, deposited either under the ice in till plains or in low moraines of regular outline. As deposited the material probably contained considerably more clay than at present, but much of the clay has been carried away in suspension.

The topography of this type is undulating to rolling. It frequently occupies the tops of small knolls a few feet higher in elevation than the surrounding soils. The slopes are never steep enough to interfere seriously with the use of heavy machinery or to cause

erosion. The natural drainage is excellent, but the type is retentive of moisture and crops do not suffer during ordinary periods of drought.

The native trees include oak, sugar maple, elm, linden, black ash, and many other species.

The soil is well adapted to general farming and nearly all the crops common to this region are grown on it. Enough alfalfa and a sufficient number of apple orchards are seen on the type to convince one that it is adapted to these crops. Sugar beets are occasionally grown, but with rather indifferent results.

Corn yields 15 to 35 bushels and wheat 15 to 30 bushels per acre. Rye and barley are not grown to any extent, but yield fairly profitable crops. Beans yield from 12 to 20 bushels, and mixed clover and timothy hay from 1½ to 2½ tons per acre.

Agricultural conditions are good, as evidenced by the buildings, fences, and general appearance of the fields. Farm land is held at prices ranging from $50 to $125 an acre.

Miami fine sandy loam, light phase.—The Miami fine sandy loam, light phase, is a light brownish gray fine sandy loam to a depth of 5 or 8 inches, underlain by yellowish-gray to yellow loamy fine sand. A small quantity of fine gravel is scattered throughout the soil section. At a depth of 4 to 6 feet cross-bedded and coarsely stratified gravel and sand are often encountered. The phase is considerably lighter throughout than the typical Miami fine sandy loam, and the heavy subsoil of the lighter phase lies at a much lower depth. The soil is easily maintained in good tilth.

This phase occurs mainly in the vicinity of Flint, Mount Morris, and Clio, and southwest of this place.

The topography is undulating or rolling, which, coupled with the loose character of the subsoil, results in excellent drainage.

The light phase of the Miami fine sandy loam is best adapted to truck farming and to some of the small fruits. At present it is devoted to the same type of farming as the heavier typical soil, though producing rather lower yields of the general farm crops. All the crops grown yield better in fairly wet seasons, though the phase is seldom droughty. Corn yields from 13 to 30 bushels; wheat, 12 to 25 bushels; oats, from 40 to 50 bushels; rye, 10 to 20 bushels; potatoes, 75 to 125 bushels; and mixed hay, 1 to 2 tons per acre.

An effort should be made to keep the soil supplied with at least its present content of organic matter by incorporating stable and green manures. A more systematic rotation of crops in which legumes have a prominent part and a more careful selection of crops adapted to the soil are recommended as means of improvement.

Agricultural conditions are generally fair. Farm lands are valued at $40 to $100 an acre.

MIAMI LOAM.

The Miami loam is the most important soil type in Genesee County, both in point of extent and agricultural value. The soil exhibits considerable variation in color, texture, structure, and topographic features. An average section of the soil would show it to be a grayish-brown or light-brown friable loam 6 to 12 inches deep. The subsoil is a heavy loam, yellowish brown in color, becoming heavier with depth, until a rather heavy clay loam, sometimes slightly mottled, is encountered in the third foot. A few stones and gravel and an occasional large bowlder are found on the surface and through the soil section, though never in such quantity as to interfere with cultivation.

When dried out a plowed field appears sometimes light gray or ashy gray in color over the slight elevations and dark gray in the depressions where poorer drainage has favored the accumulation of more organic matter, giving the field a patchy appearance. This is true of the more level portions of the type. The rougher or more rolling land has a uniform yellowish-gray color when dry and light-brown or gray when wet. The soil nearly always contains sufficient clay to form clods if worked when too wet, but ordinarily a good tilth is maintained with a reasonable expenditure of labor.

The Miami loam occurs in an extensive area covering the greater part of the county. The type occupies level to hilly upland, the greater proportion being gently undulating to rolling. Natural drainage is fair to good, considering the heaviness of the subsoil, but in the more level portions artificial drainage by open ditches or tile must be employed to give the best results.

The type is derived from the weathering of glacial drift which was deposited in plains under the ice sheet, in rolling moraines deposited at the borders of the ice sheet upon its recession, or of water-laid deposits which are smooth, low ridges raised a few feet above the surrounding plain. The greater proportion of the material occurs in the till plains.

The soil originally supported thick forests of nearly all the trees native to this general region, including several species of oak, sugar maple, elm, hickory, walnut, linden, ash, and a scattering growth of the softwoods.

This is the best soil in Genesee County for general and dairy farming, and specialization of crops has been carried on to some extent. It has a wide range of adaptation, all of the staple and some of the special crops common to the county and to this part of Michigan being grown on it and usually producing excellent yields.

Corn yields 25 to 65 bushels per acre, with an average of 30 bushels; wheat, 15 to 40 bushels. Occasional yields as high as 50 bushels

of wheat per acre have been reported. During the last few years, particularly in 1912, conditions have not been favorable for the growing of wheat. Oats yield 40 to 75 bushels, averaging 50 bushels; and beans, 15 to 30 bushels, averaging 20 bushels per acre. Buckwheat, rye, and barley are grown to some extent and give fair yields, but the soil is considered more valuable for other crops. Potatoes yield 50 to 100 bushels but are not grown on a commercial scale. Sugar beets yield 7 to 14 tons per acre and are of very good quality. Hay is an unusually good crop. The mowings are seeded to red clover and timothy mixed, at the time of sowing wheat. Yields of 1½ to 4 tons of hay per acre are obtained.

Agricultural conditions on the Miami loam are good to excellent, as is evidenced by the large barns, neat farm houses, good fences, and the general appearance of prosperity over the entire type. A great improvement, however, could be brought about by tile drainage, especially on the more level areas. Adequate drainage would lengthen the growing season and cause the soil to assume more uniformly a good tilth with less labor. Fields of alfalfa and orchards of winter apples found on this soil make it certain that more land ought to be devoted to these crops. Artificial drainage would be advisable where alfalfa is to be grown. Suggestions for further improvement would include the employment of more and heavier horses and heavier machinery, thus reducing the cost of labor. Deeper plowing should be resorted to. It would also in general be advisable to keep more stock on the farms.

Farm land on this type ranges in value from $35 an acre where remote from shipping points to $200 an acre in the vicinity of Flint. A reasonable estimate of the average price is about $100 an acre.

Miami loam, gravelly phase.—The Miami loam, gravelly phase, is a grayish-brown light loam or sandy loam about 6 inches deep, underlain by yellowish-brown loam, becoming heavier and more compact under 2 feet. Both soil and subsoil contain a quantity of gravel, the rock fragments varying in size from that of fine gravel to small bowlders. The greater percentage of the gravel is 2 to 4 inches in diameter and the bowlders are not numerous enough to interfere seriously with the cultivation of intertilled crops. The soil is easily maintained in good tilth.

The gravelly phase of the Miami loam has a rather small extent. It occurs mainly in Fenton and Argentine Townships. There is a small area in the northern part of Gaines Township.

The phase owes its origin to the weathering of glacial drift laid down as moraines. The surface features are typically morainic, being rolling to hilly, and occasionally rough. The presence of the gravel on the surface, where it is most evident, is due partly to the

washing out of the finer material from the gravelly till on the slopes and hilltops. Natural drainage is good.

All the trees of the typical soil are found on the gravelly phase of the type.

This soil is well adapted to the growth of winter apples, and more of the steeper slopes and more gravelly soil should be devoted to this fruit. All the general farm crops are grown, producing profitable yields, though this phase is not so productive as the typical Miami loam.

The condition of the farms is fair. The land is held at prices ranging from $45 to $75 an acre.

MIAMI CLAY LOAM.

The Miami clay loam, to a depth of 6 to 9 inches, consists of a light-brown or grayish-brown heavy silty loam or silty clay loam. This variation in color within the type is caused by differences in topography. In the poorer drained or depressed areas the surface is dark brown or dark grayish brown, when moist, owing to the greater accumulation of organic matter. Where erosion has taken place on the steeper slopes the surface, when dry, has a distinctly grayish color, owing to the fact that the lighter colored subsoil has been turned up by the plow. A thin layer of gray silty material is often encountered at a depth of 8 to 12 inches. The subsoil is light-brown or yellowish-gray silty clay loam to a depth of 2 feet, becoming heavier in the third foot of the section. It is sometimes mottled with gray in the lower part of the 3-foot profile.

Usually there is a fair proportion of organic matter and a small quantity of fine and very fine sand in the soil. Occasionally some gravel is present throughout the soil and subsoil, but bowlders are seldom seen on this type. Great care in plowing and subsequent cultivation has to be exercised to avoid clodding and baking, for organic matter is not present in sufficient quantities to prevent the soil from becoming lumpy if cultivated when wet.

The Miami clay loam occurs in many areas varying in extent from a few acres to 5 or 6 square miles, and scattered throughout the county. The largest single area is found in Thetford Township. Several areas of considerable extent occur in the southwestern and western parts of the county.

This type is developed from morainic material. In topography it varies from level to rolling, with local differences in elevation ranging from 10 to 25 feet. Low, rounded ridges and occasional more prominent knolls, which indicate the glacial origin of the soil, are the principal topographic features. Natural drainage is

fair over the more rolling areas, in which category the greater proportion of the type falls. Only the small depressed areas are poorly drained.

The native vegetation consists of oak, black walnut, hickory, and some elm, sugar maple, beech, and other hardwoods.

The Miami clay loam constitutes one of the strongest soils in Genesee County for general farming. It is best adapted to dairy farming, grains, and grasses. When well drained, orchards of winter apples, pears, and cherries succeed.

Corn yields from 15 to 30 bushels per acre, the average being about 18 bushels with occasional yields of as high as 75 bushels reported. Oats yield 40 to 60 bushels, the average being about 50 bushels per acre. Wheat yields 15 to 35 bushels and beans 8 to 20 bushels. Clover and timothy are usually sown together and yield $1\frac{1}{2}$ to $3\frac{1}{2}$ tons of hay per acre, with an average of about $1\frac{3}{4}$ tons. A field is usually kept in sod three years. During the second season the clover runs out, and an average yield of $1\frac{1}{4}$ tons of timothy is obtained the third season. Sugar beets are not grown extensively on this type. They produce a yield of 5 to 10 tons per acre. Potatoes are not grown for market.

Conditions are usually good on the Miami clay loam. The farms range in size from 50 to 160 acres and are fairly well equipped with buildings and machinery. A few dairy cows are kept on nearly all farms. A little commercial fertilizer of a fair grade is used, together with the manure that is made on the farms.

Recommendations for improvement would include artificial drainage, a more systematic and careful rotation of crops, and the keeping of more stock. Tile drainage would remove the excess water in the spring, at the same time aiding in aeration and make it possible to prepare the land for crops earlier. A shorter rotation, one in which considerable clover is returned to the soil, would prove beneficial. The soil is well supplied with lime, as is shown by the success of clover upon it.

The type ranges in value from $35 to $100 an acre, depending on the condition of the land and improvements in the way of buildings, fences, and drainage.

CLYDE FINE SANDY LOAM.

The Clyde fine sandy loam, to a depth of 10 to 12 inches, is a very dark-brown fine sandy loam with a high organic content. A considerable quantity of white fine sand often imparts to the surface a grayish tone. The subsoil to a depth of 30 inches is a dark-gray loamy fine sand, below which it is a yellow, sticky sand or sandy clay. A small quantity of fine gravel is sometimes found scattered over the surface. The soil is friable and easily kept in good tilth under optimum moisture conditions.

The Clyde fine sandy loam is found in the northwestern part of Genesee County, occurring in Thetford, Vienna, Montrose, and Flushing Townships. In point of area it is one of the most important soils in the county. The type consists of glacial material reworked by stream and wave action. It was deposited under the waters of glacial Lake Saginaw and left bare upon the subsidence of the lake.

The surface is even and unbroken, the topography being level or very gently undulating, with only slight differences in elevation. Natural drainage is usually only fair.

The native vegetation consists of elm, soft maple, poplar, and such other trees as could thrive under the wet conditions existing before the soil was cleared and drained.

Unlike the sandy soils of the upland, the Clyde fine sandy loam is quite well adapted to the growing of the heavier general farm crops. When well drained it is also well suited to the production of berries, small bush fruits, and the heavier truck crops. Some of the tree fruits are also produced with fair success.

Corn yields 10 to 25 bushels; oats, 35 to 60 bushels; beans, 8 to 20 bushels; wheat, 15 to 25 bushels; buckwheat, 20 to 25 bushels; hay, 1 to 1¾ tons; and sugar beets, 7 to 12 tons per acre. The more level areas are adapted to the growing of sugar beets, but in order to secure good results it is necessary to keep the soil well supplied with organic matter by applying stable or green manures.

Agricultural conditions on the Clyde fine sandy loam are only fair. During a rainy season the fields are often so wet that they can not be properly cultivated. A reasonable investment in tile drains would prove to be a permanent improvement. Tile drains would not only remove the excess water in rainy times but would assist in maintaining a supply of available moisture in times of drought. A light application of lime would probably prove beneficial to most of this type.

The Clyde fine sandy loam has a range in value of $40 to $100 an acre, depending on improvements in buildings and drainage and nearness to markets or shipping points. Small farms have occasionally been sold for as high as $300 an acre.

Clyde fine sandy loam, coarse phase.—The surface soil of the Clyde fine sandy loam, coarse phase, consists of a dark-gray to black sandy loam ranging in depth from 8 to 14 inches, with a considerable admixture of fine sand. The subsoil is a yellowish-gray or gray loamy sand, becoming coarser in texture and lighter in color to a depth of 30 inches or 3 feet. Yellow, sticky, sandy clay is frequently encountered at that depth. An inconsiderable quantity of fine gravel occurs in the soil. Like all the soils of the Clyde series, the organic content is large. The soil is friable, mellow, and easily kept in good tilth when drained.

The most important development of the phase is found in Montrose Township and in some other areas southwest of Montrose village. Two isolated tracts are found south of Grimes, in Argentine Township.

The soil is of glacial origin and represents reworked material deposited in lakes.

Very slight local differences in elevation give to the surface a gently undulating appearance. Natural drainage is poor. Where the soil occurs in some slight depressions swampy conditions exist.

The native vegetation consists of elm, soft maple, some sugar maple, poplar, and white pine. Tamarack and willow grow in the poorly drained depressions.

The Clyde fine sandy loam, coarse phase, is adapted to the growing of the general farm crops and to strawberries and bush fruits when well drained. Cabbage, root crops, and the heavier truck crops also succeed.

Corn yields 15 to 25 bushels; wheat, 15 to 25 bushels; beans, 10 to 15 bushels; and hay, 1 to 1½ tons per acre.

Agricultural conditions as a whole are not good. A considerable part of the tract north of Montrose has not been developed at all. The land ranges in value from $25 to $65 an acre.

CLYDE LOAM.

The Clyde loam consists of a friable to rather silty loam 9 to 14 inches deep, of a dark-brown or brownish-gray to nearly black color. This is underlain by a dark-gray to yellowish-gray heavy loam to clay loam, often mottled with iron stains. The soil was formerly poorly drained and in a semiswampy condition, which favored a relatively large accumulation of organic matter. As a result of poor drainage much of the soil is still in a puddled condition, and if plowed too wet and allowed to dry forms such hard clods that it is very difficult to reduce it to a state of good tilth. This is not true of the more mucky parts of the type, which are naturally loamy and mellow.

The Clyde loam, though not of great area, constitutes an important soil. It occurs mainly in the northwestern part of the county in association with the Clyde fine sandy loam. This type is best in the tract situated in Gaines Township, owing to the more loamy and friable condition of the soil. A small area of the type occurs in Argentine Township.

The material constituting the Clyde loam is reworked glacial material deposited under lake waters at the time of the recession of the ice sheet.

The topography is almost level, with occasional slight elevations. The color of the soil varies somewhat with the slight difference in

elevation. The level surface, together with the impervious nature of the subsoil, causes poor drainage.

The native trees include elm, soft maple, linden, oak, hickory, and some other hardwoods on the slight elevations.

The Clyde loam is best adapted to general farming and is used for that purpose. It is better adapted to the growing of sugar beets than any other soil in Genesee County, and this crop is planted extensively.

Corn yields from 20 to 40 bushels per acre with a high average; wheat, 10 to 40 bushels; oats, 25 to 60 bushels, averaging 40 bushels; barley, about 30 bushels; rye, 15 to 25 bushels, averaging 20 bushels; hay, 1½ to 3 tons; sugar beets, 10 to 20 tons, with an average of 12 tons; cabbage, 10 to 15 tons, averaging 12 tons per acre.

Conditions on the Clyde loam are fair to good. A five-year to seven-year rotation is practiced and the soil is continuously cropped. The most essential improvement for the type is better drainage. A reasonable investment in tile drains will result in a certain and marked improvement. It will result in longer growing seasons and easier cultivation for most of the type, and consequently better crops. While the greater part of this soil is developed and open ditches are common, not much attention has been given to tile drainage. More stock should be kept on the farms, as it is necessary to keep up the organic content of the soil in order to secure good results.

Land of this type ranges in value from $50 to $125 an acre, depending on improvements and nearness of shipping points. None of the type is very remote from a railroad.

Clyde loam, light phase.—To a depth of 9 to 12 inches the Clyde loam, light phase, consists of a dark grayish brown loam, containing sufficient clay to clod when worked in a wet condition. The subsoil is a grayish heavy loam, becoming clay loam to clay in the third foot of the section, sometimes being mottled with reddish brown. Variations in the subsoil give rise to a lighter phase of the type, but in general the soil is a heavy loam. When well drained the soil is mellow and friable, on account of a relatively high content of organic matter, and is maintained in fair tilth with a reasonable expenditure of labor.

The largest and most important developments of this phase occur south of Otterburn and Swartz Creek, and in Clayton and Flushing Townships along the border of the county. Other less important areas are found in Thetford Township. When well developed this is an important and valuable soil.

This soil is composed of reworked glacial material deposited under wet conditions, giving rise to rather large accumulations of organic matter. The soil was formed either under shallow pond waters or in swamps which endured for a long time. Till, or bowlder clay, is in evidence at depths of 3 to 6 feet.

The surface of the Clyde loam, light phase, is level or very gently undulating. Where the topography becomes more nearly rolling the phase grades into Miami loam or Miami clay loam. On account of the heavy character of the subsoil, natural drainage is generally poor.

The native trees on this phase are oak, hickory, sugar maple, beech, elm, and other hardwoods.

The Clyde loam, light phase, constitutes one of the best soils of Genesee County for all the heavier general farm crops and for sugar-beet culture. All crops succeed best in moderately dry seasons. Corn is a good crop, but matures slower on this soil than on the Miami soils of the same or lighter texture. The average yields of the general farm crops are as follows: Corn, 35 bushels per acre, with occasional reports of as high as 60 bushels; wheat, 20 bushels; oats, 50 bushels; beans, 18 bushels; and mixed hay, 2 tons per acre. Sugar beets yield from 5 to 15 tons, the average being about 10 tons per acre, and are extensively grown. Cabbage is grown to some extent and yields an average of about 10 tons per acre.

Agricultural conditions are generally excellent on this soil. The farms are of medium size and well equipped with buildings and farming machinery. Not much stock is kept, but what manure is made is carefully utilized.

Several county drains have been opened through this soil. Tile drainage has not been practiced to any considerable extent, but it would prove very beneficial.

The naturally wet condition of this soil renders it unsuited for cultivation without artificial drainage. It is found only where the impervious clay layer is close to the surface.

The native vegetation consists of only a sparse growth of hardwood trees and the rank grasses found on wet soils.

When drained the soil is well adapted to corn and grass, producing yields of 20 to 38 bushels of corn and an average of 2 tons of hay per acre. At present it is used mainly for pasture and the production of hay.

The essential in the improvement of the type is drainage. Applications of lime would also prove beneficial.

A reasonable estimate of the value of this land seems to be from $45 to $80 an acre. Some farms are held as high as $125 an acre.

CLYDE CLAY LOAM.

The soil of the Clyde clay loam, to a depth of 6 to 12 inches, is a dark grayish brown, dark-brown, or black silty loam to clay loam, containing a considerable proportion of organic matter. The subsoil is a heavy drab or gray silty clay or clay. The soil is apt to crack and clod and is hard to maintain in good tilth. The subsoil is

sticky and plastic and so compact as to be practically impervious to water.

As it occurs in Genesee County the Clyde clay loam is of little importance, embracing but 832 acres. Several small areas are found in Grand Blanc Township, others in Gaines and Argentine Townships. The type is of glacial origin.

The topography is level, the type often occupying depressions or areas with insufficient drainage outlets, which fact has given rise to the large accumulation of organic matter.

COLOMA FINE SANDY LOAM.

The Coloma fine sandy loam, to an average depth of 6 inches, consists of a light-brown to yellowish-brown rather heavy fine sandy loam or sandy loam, usually carrying a small proportion of fine gravel and a scattering of stones and small bowlders upon the surface. The subsoil is a yellowish or yellowish-gray heavy fine sandy loam, containing some fine gravel and sometimes a considerable percentage of medium sand. A gravelly stratum is often encountered at a depth of 3 feet. The soil is inclined to clod if plowed in a wet condition, but ordinarily it works into good tilth.

The Coloma fine sandy loam is confined to the northeastern part of the county, being found in Forest and Thetford Townships. It consists of reworked glacial material, and some of the stonier areas are derived from morainal deposits.

The topographic features are much diversified. The greater proportion of the type is rolling and broken by low ridges and irregular hillocks. Drainage is, therefore, thorough and in dry seasons crops sometimes suffer from drought.

The Coloma fine sandy loam originally supported a comparatively thick growth of white and Norway pine, but these have all been removed, and where the land is not farmed a second growth of scrub oak has sprung up.

This type is farmed to the general farm crops, which give moderate yields. It is adapted to apple orcharding and should be more extensively utilized for this purpose, especially as much of the soil is comparatively remote from markets, and therefore not so well suited for the production of more perishable products.

Corn yields 13 to 20 bushels; oats, 30 to 50 bushels; wheat, 10 to 20 bushels; rye, 10 to 25 bushels; beans, 8 to 16 bushels; and hay, 1 to 2 tons per acre. Red clover does not thrive on this soil.

Dairy farming and sheep raising, with the production of apples as a specialty, would probably be a profitable type of farming on the Coloma fine sandy loam. With the dairy herd and sheep it would be possible to utilize the roughage on the farms and return the manure to the soil, which is necessary in order to maintain the soil in a state

of productiveness. Lime would undoubtedly improve the condition of the soil.

Conditions as a whole are only fair on this type. Farm land is valued at from $25 to $50 an acre.

Coloma fine sandy loam, light phase.—The Coloma fine sandy loam, light phase, to an average depth of 6 inches, consists of a light-brown to yellowish-brown light fine sandy loam to sandy loam containing a varying though usually small quantity of fine gravel. This is underlain to the depth of 3 feet or more by yellow loamy fine sand, which is usually gravel free, but occasionally contains a small quantity of fine gravel. The soil is always easily worked.

This phase occurs mainly in Thetford Township in association with the typical soil. Two small areas are situated in Forest Township, northeast of Otisville, and another in Atlas Township, southeast of Goodrich.

The phase has originated from glacial material reworked by wind and water. The more gravelly portion is undoubtedly morainic.

The surface features are the same as those of the typical soil, the topography being rolling to hilly. Drainage is sometimes excessive.

The original forest growth consisted principally of white and Norway pine.

Were this soil situated near to markets it would prove profitable for the growing of light truck crops. At present it is farmed to the same crops and in the same manner as the typical Coloma fine sandy loam. As the soil is of relatively little importance, no separate value can be placed on it.

COLOMA LOAM.

The surface soil of the Coloma loam consists of a grayish-yellow loam, ranging in depth from 5 to 9 inches. It contains sufficient clay to clod badly when worked in a wet condition. If properly cultivated, however, the soil breaks up into a friable condition. The subsoil is a yellowish, heavy loam to clay loam, mottled with iron stains in the lower depth. The deep subsoil is sometimes a sticky sandy clay merging into gravelly sandy loam. Gravel in varying quantities and sizes is always present on the surface and the type is frequently stony. The larger stones have been removed from many fields where they interfered with cultivation.

The Coloma loam is of comparatively small extent, being confined to the northeastern part of the county, in Thetford and Forest Townships.

This type is derived from glacial material deposited in the form of moraines and has the typical morainic topography, being rolling to hilly, though the slopes are seldom steep enough to interfere seriously with the use of ordinary farming machinery.

The Coloma loam is distinguished from the Miami loam by the lack of limestone in the glacial drift, there being usually an abundance of limestone in most of the soils of the Miami series.

The natural drainage, on account of the topography, is usually good. Many small depressions of an acre or so, or areas with insufficient drainage outlets, occur within this type. Where these are large enough they have been mapped as Meadow.

The native trees are mainly white and Norway pine and hemlock, among the softwoods, and scrub oak, sugar maple, and other hardwoods.

Fair yields of the staple crops are obtained but the type is not nearly so productive as the Miami loam. The yields are as follows: Corn, 20 to 40 bushels per acre, although in very favorable seasons yields of as high as 50 bushels have been obtained; oats, 30 to 55 bushels, with an average of 35 bushels; wheat, 10 to 30 bushels, averaging 18 bushels; beans, 8 to 15 bushels; and barley, 10 to 18 bushels per acre. Potatoes yield 75 to 100 bushels, but are not grown for market. Peas have been tried without success. Hay yields 1 to 2 tons per acre, the average being about 1¼ tons. Some difficulty is experienced in getting a stand of red clover. Alsike clover succeeds fairly well and should be grown more extensively.

Agricultural conditions as a whole are only fair on this type. Much of it is better suited to pasture than to continuous cropping. Where possible, a rotation in which pasture has a place will prove the best. More stock should be kept. Fields should not under any circumstances remain in sod longer than two years. Liming would undoubtedly benefit the type as a whole.

The land is held at prices ranging from $30 to $70 an acre. A fair average would probably be $45 an acre.

The following table gives the results of mechanical analyses of samples of the soil and subsoil of the Coloma loam:

Mechanical analyses of Coloma loam.

Number.	Description.	Fine gravel.	Coarse sand.	Medium sand.	Fine sand.	Very fine sand.	Silt.	Clay.
		Per cent.	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*
301025	Soil	1.8	5.1	8.3	25.0	14.5	36.2	9.2
301026	Subsoil	1.2	5.0	8.8	23.3	12.8	30.7	18.1

FOX GRAVELLY SANDY LOAM.

The surface 6 or 8 inches of the Fox gravelly sandy loam consists of a light-brown to yellowish-gray fine sandy loam or light gravelly fine sandy loam. The subsoil is light-brown or yellowish gravelly sandy loam to a depth of 18 inches or 2 feet, grading beneath into

gravel or gravelly sand, gray in color. The gravel varies in size from fine gravel to small stones 4 to 6 inches in diameter. Bowlders are never found in this type. The gravel consists of waterworn fragments of sandstone, granite, gneiss, schist, chert, and a varying though usually large proportion of limestone fragments. Some of the gravel has a calcareous coating and lumps of small gravel cemented together by the same material frequently occur. The upper 2 feet of the soil section is a heterogeneous mass of the various grades of sand and gravel underlain by stratified and cross-bedded sand and gravel. The surface soil is always friable and can be worked under a wide range of moisture conditions.

The type occurs as terraces, which have been eroded considerably, along several of the streams of the county, particularly along the Flint River. In the vicinity of Flushing it widens from a comparatively narrow band into a terrace about 3 miles wide on the east side of the river, forming the most important tract of the type. Other terraces of the same material of considerable importance are situated on both sides of the Shiawassee River.

The material composing the Fox gravelly sandy loam has been laid down by glacial streams at the time of the recession of the ice sheet, representing the coarser material deposited by the swiftest water.

The topography is that of a sloping terrace, somewhat dissected by erosion, giving it an undulating or rolling appearance. Natural drainage is good and sometimes excessive.

The native trees consist of oak, maple, and other hardwoods, with a scattering growth of white pine.

The soil is adapted to the growing of the lighter general farm crops and to dairy farming, as well as to apples, pears, and canning crops.

A wet season is more favorable to the crops grown on the Fox gravelly sandy loam than a dry season. In favorable seasons corn yields from 20 to 40 bushels; oats, 30 to 55 bushels; rye, 15 to 25 bushels; potatoes, 100 to 175 bushels; and mixed hay, 1 to 2½ tons per acre. Wheat, while not adapted to this soil, yields 10 to 20 bushels per acre. No difficulty is had in procuring a fair stand of red clover.

Conditions are generally good on the Fox gravelly sandy loam. The incorporation of more organic matter in the form of stable and green manures and more careful cultivation of the intertilled crops in order to conserve soil moisture may be suggested as means of improving this soil. A rotation of corn, oats, wheat, and hay for one or two years at the most would prove better than a longer rotation. Alfalfa would probably be a profitable crop on some areas, as evidenced by the abundant growth of sweet clover.

Land of this type ranges in value from $40 to $80 an acre or more, depending on location with regard to shipping points.

FOX SAND.

The Fox sand to an average depth of 6 inches consists of a brownish-yellow loamy sand, carrying a considerable proportion of fine sand, which, coupled with a small amount of organic matter, gives it a loamy texture. The subsoil is an incoherent pale-yellow medium sand, which becomes very loose below a depth of 2 feet. A scattering of fine gravel occurs on the surface and throughout the soil. The soil body ranges from many feet in depth to a thin deposit where it overlaps the till. Stratification is evident in the lower subsoil. The soil can be cultivated under nearly all conditions of moisture content.

The type occurs as gently undulating terraces along some of the principal streams of the county. The largest and most important tracts are found along the Flint River, one south of Rogersville, in Montrose and Flushing Townships, and in Fenton and Argentine Townships along the Shiawassee River. Natural drainage is good, if not excessive. In dry seasons crops suffer from lack of moisture because of the loose nature of the lower subsoil.

The type was formed by glacial stream action and represents the sorting out of some of the coarser material by comparatively swift currents.

The native vegetation consists of white and Norway pine, hemlock, and some oak, maple, and elm.

The soil is adapted to the growing of melons, strawberries, small bush fruits, the lighter truck crops, and early potatoes, and should be devoted to this type of farming. At present the general farm crops of the county are grown with indifferent success. Corn yields 13 to 20 bushels per acre; wheat, 8 to 15 bushels; rye, 10 to 15 bushels; oats, 25 to 40 bushels; potatoes, 75 to 150 bushels; and mixed hay, three-fourths ton to $1\frac{3}{4}$ tons per acre.

This type may be improved by deeper plowing, with frequent manuring, more careful cultivation to conserve soil moisture, and a more careful selection of crops adapted to the soil.

FOX SANDY LOAM.

The surface soil of the Fox sandy loam to an average depth of 10 inches consists of a brown or brownish-gray loamy sand with a considerable proportion of fine sand. This is underlain to a depth of about 24 inches by yellow, loamy fine sand or sand, which in turn is underlain by grayish-yellow loamy sand to a depth of more than 3 feet. The soil usually has a fair content of organic matter. It is maintained in excellent tilth with a reasonable expenditure of labor.

The Fox sandy loam is of small extent and of no great importance. It is frequently situated within areas of Fox fine sand or sand. The

largest and most important areas are found in Montrose, Flushing, and Argentine Townships. Other less important areas occur in Genesee and Grand Blanc Townships. The type represents material deposited by streams in comparatively swift motion and is of glacial age.

The Fox sandy loam occurs as gently sloping to considerably eroded and rolling terraces along some of the larger streams in the county, especially the Flint and Shiawassee Rivers. The drainage is good.

Scattering growths of white pine, hemlock, sugar maple, beech, and oak are found on this soil.

This type is an excellent garden soil, and a part of it is devoted to growing garden crops, strawberries, and small bush fruits. It is also well adapted to the production of potatoes. A considerable proportion of the soil is devoted to the lighter general farm crops and grains and produces fair yields. Corn yields 13 to 25 bushels; oats, 20 to 40 bushels; potatoes, 100 to 250 bushels; and mixed hay, 1 to 2 tons per acre.

A reasonable estimate of the value of land of this type would be $40 to $60 an acre.

FOX FINE SAND.

The surface soil of the Fox fine sand consists of a light-brown or yellowish-brown, somewhat loamy fine sand from 4 to 8 inches deep. This is underlain by yellow fine to medium sand, showing some evidence of stratification and usually containing some fine gravel in the third foot of the section. Varying quantities of organic matter in the surface few inches impart to the soil a somewhat loamy texture. The subsoil is loose and incoherent. The soil can be worked under a wide range of moisture conditions.

The Fox fine sand occupies gently sloping to much-eroded and rolling stream terraces along several of the larger streams of the county, particularly the Flint River. The largest area occurs south and east of the Flint River, extending from a point north of Richfield, in Richfield Township, to the city of Flint. Other areas of considerable extent occur in Montrose Township. Owing to the rolling topography and the incoherent subsoil, the type is well to excessively drained. The type is of glacial age and stream deposition.

The native vegetation consists of white pine, hemlock, poplar, soft maple, and scrub oak.

The soil is adapted to the growth of such truck crops as melons, summer squash, radishes, early onions, and early potatoes. At present the general farm crops are grown. Corn yields 10 to 40 bushels of ears per acre, the crop varying with the rainfall, a wet season being the most favorable; oats, 20 to 50 bushels, with an average of 25

bushels; beans 5 to 15 bushels, averaging 8 bushels; rye, 10 to 20 bushels; potatoes, 100 to 250 bushels; mixed hay, three-fourths ton to 2 tons, averaging 1 ton per acre. Mammoth Red clover is the variety usually grown, and no particular difficulty is had in getting a stand of it. Wheat is not commonly grown on this soil. Strawberries and small bush fruits are generally successful.

Considerable manure is hauled from Flint and applied on this soil, since no dairy herds are kept on the type. Some commercial fertilizer, usually an inferior grade, is used.

The land brings from $30 to $60 an acre, the average price being about $40. The value depends mainly on location of the areas with respect to Flint, which is the market for most of the crops grown on this type.

FOX FINE SANDY LOAM.

The surface soil of the Fox fine sandy loam to a depth of 8 inches is a light-brown or yellowish-brown fine sandy loam, having a yellowish-gray appearance when dry. This is underlain by grayish-yellow or yellow loamy fine sand or light fine sandy loam, becoming coarser in texture in the third foot of the section. The soil is friable and easily maintained in good tilth under almost any condition of moisture content.

This type, like the others of the Fox series, occurs as terraces along the principal streams of the county. The largest and most important tracts occur in bands from a few rods to a half mile wide along the Flint River. The material composing the soil is glacial in age and was deposited by streams at about the time of the recession of the ice sheet.

The topography is gently sloping to rolling, and drainage is well established.

The native tree growth consists of white pine, hemlock, oak, beech, maple, elm, and hickory.

The soil is adapted to light general farming or dairy farming. Fruits, such as apples, pears, and the small bush fruits, should prove successful. Corn yields 13 to 25 bushels per acre; oats, 30 to 50 bushels; wheat, 10 to 20 bushels; rye, 10 to 18 bushels; potatoes, 75 to 125 bushels; and hay, 1 to 2¼ tons per acre.

Clover is successful on this soil, and it would be well to use this crop as green manure where stable manure is not available. Stable manure should be carefully conserved and applied and every means taken to maintain a good supply of organic matter in the soil. Shorter rotations are recommended, as it is not advisable to keep this soil more than two years in sod.

Conditions on the Fox fine sandy loam are poor to good. The selling price of the land ranges from $40 to $65 an acre.

DUNKIRK GRAVELLY SANDY LOAM.

The Dunkirk gravelly sandy loam, to an average depth of about 6 inches, consists of a yellowish-brown or light-brown, light gravelly fine sandy loam to gravelly sandy loam. The subsoil is a light-yellow gravelly sandy loam or gravelly sand. Both soil and subsoil contain a relatively large proportion of waterworn gravel and small stones. The soil is stratified, with an increasingly large proportion of gravel toward the bottom of the section.

The soil is easily cultivated on account of its loose and friable character, and can be worked under a wide range of moisture content.

The Dunkirk gravelly sandy loam in Genesee County is found mostly in Vienna and Thetford Townships, extending in a general northeasterly and southwesterly direction.

The type occupies long, low, narrow ridges, representing remnants of a glacial-lake beach line, the material having been thrown up and sorted by wave action during the short time that the lake waters stood at that level.

The native trees are white pine, hemlock, soft maple, oak, and a scattering of other hardwoods.

The soil is adapted to the growing of truck and the lighter general farm crops. Corn yields 15 to 30 bushels per acre; wheat, 10 to 20 bushels; oats, 30 to 50 bushels; rye, 10 to 20 bushels; beans, 8 to 15 bushels; early potatoes, 100 to 150 bushels; and mixed hay, 1 to 2 tons per acre. Mammoth and medium red clover and timothy are usually sown together.

For improvement of the soil may be suggested a more systematic and shorter rotation of crops in which legumes have a prominent place and the incorporation of more organic matter in the soil by the application of stable and green manures.

The type is generally farmed in connection with other soils, and when sold is sold in connection with other and heavier soils. Probably a reasonable estimate of its value is from $35 to $70 an acre, depending on improvements in the way of buildings and on nearness to markets and shipping points.

DUNKIRK FINE SAND.

The Dunkirk fine sand to a depth of 6 to 10 inches is a light-brown fine sand, a small content of organic matter and of very fine sand imparting to it a slightly loamy texture. The subsoil is a loose, incoherent, fine sand, yellow or orange in color, becoming coarser in texture and lighter in color to a depth of 2 to 3 feet. Both soil and subsoil are free from gravel or stones. On the lower slopes of the knolls and where the type occupies small depressed areas, favoring a greater accumulation of organic matter, the surface soil becomes

gray or brown and the subsoil frequently merges into yellow, sticky sand below a depth of 30 inches.

The Dunkirk fine sand occurs in limited areas in Thetford, Vienna, Montrose, and Clayton Townships. The type occupies glacial-lake plains and varies in topography from nearly level to gently rolling. In some areas low, rounded knolls occur. The type represents remnants of lake beach or lake sands redistributed by wind action.

The loose, incoherent nature of the subsoil, together with the rolling topography, causes this type to be thoroughly, sometimes excessively, drained. In an average season, however, a sufficient moisture content is maintained in the soil for the production of early truck crops, to which type of farming the soil should be devoted. At present it furnishes a meager amount of pasturage, which dries up in the heat of summer.

Suggestions for improvement of the Dunkirk fine sand include a more careful selection of crops to which the soil is adapted, liberal application of manure, and deeper plowing.

PLAINFIELD GRAVELLY SANDY LOAM.

The Plainfield gravelly sandy loam, to an average depth of 5 inches, is a grayish-brown fine sandy loam to sandy loam. This is underlain by reddish-brown loamy gravelly sand to gravelly sandy loam. Coarser material, varying in size from fine gravel to small bowlders, is liberally scattered over the surface and occurs in increasing quantities to the bottom of the section. The material is stratified below 2 feet. The soil is friable and easily worked.

The type occupies an area about 1 square mile in extent and is confined to the northern part of Forest Township. It is associated with soils of the Coloma series. The type represents glacial outwash deposits.

The surface of the soil is considerably broken and cut up by streams, giving it a rough, rolling topography. The drainage is good.

Originally the area was forested mainly with white pine, in which a scattering growth of scrub oaks and other hardwoods occurred.

Agricultural conditions on this type are poor. The soil is of little importance and is generally farmed in connection with the adjoining soils. No separate value can be given for it.

GENESEE FINE SANDY LOAM.

The soil of the Genesee fine sandy loam consists of a dark-gray, grayish-brown, or brown fine sandy loam to very fine sandy loam or light, friable loam to a depth of 8 to 12 inches. The subsoil is a yellowish-gray loamy fine sand or light fine sandy loam, usually merging

into a gray fine sand, though sometimes becoming heavier with depth. The soil is loose and mellow, contains a considerable quantity of organic matter, and is easily maintained in good tilth.

This soil type is of alluvial origin and occurs in narrow bands along many of the streams of the county. It represents the coarser material deposited in times of floods.

The surface of the Genesee fine sandy loam is level, or slightly eroded, but, except in times of high water, which occurs frequently, the type is naturally well drained, on account of the loose and open nature of the subsoil.

Much of the type is cleared and in use as pastures. Because of the danger of inundation very little of it is used for cultivated crops. It is only farmed in connection with other soils, and no separate value can be placed on it.

GENESEE LOAM.

The Genesee loam consists of a brown or dark-brown silty loam or silt loam, with an average depth of 10 inches, underlain by a silty loam, usually light brown in color, becoming sandy below a depth of 2 feet.

This soil, like the Genesee fine sandy loam, is of alluvial origin, and is stratified in the lower depths of the soil section, causing considerable variation in the subsoil. The surface soil, however, is relatively uniform in color and texture, owing largely to the influence of weathering and to mixing by plant roots, animals, and cultivation.

The Genesee loam occurs in conjunction with the Genesee fine sandy loam along the narrow stream bottoms. It is a strictly alluvial soil, the material having been brought down and deposited in times of high water. It is subject to frequent overflow, and the drainage is usually poor, owing to the low position of the soil. The type is not generally farmed because of the danger of inundation and the narrowness of the bottoms. It supports a luxuriant growth of pasture grasses and is devoted almost entirely to pasturage.

RODMAN GRAVELLY SANDY LOAM.

The Rodman gravelly sandy loam is a brown or light-brown light gravelly sandy loam to a depth of about 12 inches. A small amount of organic matter in the first 4 to 8 inches gives the surface soil a slightly more loamy texture. The upper subsoil is usually a light-brown gravelly sand to a depth of 20 inches, underlain by grayish gravelly sand or gravel. The gravel contained in the upper foot of the soil section is usually fine, becoming coarser with depth. The gravel consists of granite, gneiss, schist, and limestone fragments, all waterworn and rounded. Much of the gravel has a calcareous coating. Beds of clay frequently occur in the deep subsoil.

The type occurs in the upland part of the county. The largest areas are located in the south-central part of the county, south of Flint, and in the eastern part. It is glacial in origin, occurring in the form of kame deposits in rounded and irregular hills. The type sometimes occurs within morainal areas, a notable instance being the area near Fenton.

White pine, hemlock, soft maple, and scrub oak, with a scattering growth of other hardwoods, formed the original forest.

Owing to the loose, porous nature of the subsoil, drainage is excessive and the soil is droughty. Where the slopes are not too steep the type is farmed to general farm crops with indifferent success. In favorable seasons corn and potatoes yield fair crops. The soil makes fair pasture land for sheep.

For the improvement of the Rodman gravelly sandy loam liberal applications of stable and green manures and a rotation of crops in which clover has a prominent part are recommended.

PEAT.

Peat as mapped in Genesee County is composed almost entirely of vegetable matter, consisting of roots, stalks, and leaves of water-loving trees and plants in various stages of decomposition. The surface 4 to 10 inches is usually black in color, being more thoroughly decomposed than the lower soil, but containing bits of branches and roots. The lower soil consists of brown, fibrous material, the plant forms often being recognizable. The soil mass is always at least 2 feet deep and often extends to a depth of many feet. The topography is flat, and the water table is usually within a few inches of the surface.

The largest areas of Peat lie in the eastern and southern parts of the county, in Forest, Richfield, Davison, Atlas, Fenton, and Argentine Townships. No single area contains more than 3 square miles. Numerous small areas are scattered throughout the county, except in the northwestern part.

The native vegetation consists principally of tamarack, with some elm, willow, and bushes of several varieties, besides reeds, rushes, flags, and many water-loving grasses.

Peat originates in low, wet areas, where swampy conditions have existed for a long time.

Only a very small proportion of the Peat has been cleared of timber and put under cultivation, and very little attention has been given to draining the larger areas. Where the soil is sufficiently well drained good summer pasturage is afforded. A few acres of Peat are devoted to the production of celery, cabbage, onions, carrots, and other vegetables, which give fair yields in favorable seasons. No separate value can be placed on this type.

MUCK.

Muck consists of an accumulation of vegetable remains in a more advanced state of decomposition than Peat, mixed with a small quantity of mineral matter carried into the areas by wash from higher surrounding areas or by the wind. It is dark brown or black in color, finely divided and very mellow, varying in depth from 2 to many feet, depending on the depth of the depression in which it was formed. Muck sometimes contains sufficient mineral matter to give it a slightly gray color and firmer structure, but in general the Muck is quite uniform in color, texture, and structure to a depth of 3 feet. The underlying material varies from a heavy drab clay to a gray sand. Upon the character of this underlying material and on its depth below the surface depends the agricultural value of Muck. Occasionally thin strata of marl, gray or chalky white in color, are encountered at a depth of 24 to 30 inches, but never in sufficient quantities noticeably to affect the upper soil.

Muck is found in all parts of the county except the northwestern. The largest areas, none of which are more than 200 acres in extent, occur in the southeastern townships, sometimes closely associated with Peat. There are many areas of Muck in Genesee County too small to represent on the map.

In topography Muck is flat. It originates, like Peat, in low, wet areas where swampy conditions have continued over long periods of time. Such areas support a luxuriant growth of tamarack, elm, soft maple, rushes, reeds, and other water-loving plants, the remains of which, accumulating faster than they decay, give rise ultimately to these organic soils.

Only a small proportion of the Muck is under cultivation, the chief crops being corn, hay, and sugar beets. Where Muck is fairly well drained naturally it has been cleared of trees and bushes and used for summer pastures.

Much of the Muck in Genesee County could be profitably drained. Because of the ease of cultivation, availability of plant food, and suitable moisture conditions when drained, Muck is especially adapted to the growing of vegetables, such as celery, onions, carrots, lettuce, cabbage, spinach, and tomatoes, and should be devoted to these crops. Peppermint growing should prove profitable, as in other parts of Michigan.

In draining Muck it is deemed advisable first to use the open-ditch method. After the excess water has been removed and the soil has settled and become more compact from cultivation, tile drains may be installed.

MEADOW.

The term Meadow, as used in the Genesee County survey, applies to narrow, low-lying, and flat areas adjacent to streams and to depres-

sions and low-lying areas in the upland. Areas along streams are subject to intermittent overflow. The water table is permanently maintained on or within a few inches of the surface, which renders the soil unfit for cultivation.

Meadow is characterized by poor drainage and a large accumulation of organic matter. The soil consists of varied material, ranging from clay to sandy loam. Some areas of Peat and Muck lie so low as to be swampy throughout the year, and these are mapped as Meadow.

Bushes, small trees, and water-loving grasses or flags usually occupy areas of Meadow. A small percentage of the area could be artificially drained to advantage, but over the greater proportion drainage would be so expensive as to be impracticable. Meadow is suitable at best only for summer pastures.

DUNESAND.

Dunesand consists of fine to very fine sand, of pale-yellow color, which, on account of its lack of moisture and the practical absence of protecting vegetation, is blown about by the wind and deposited in heaps or dunes. In structure it is loose and incoherent, especially at the surface.

Only a small area of Dunesand is found in Genesee County. It occurs in four small areas of a few acres each in the northern part of the county. While these areas lack the typical dune formation, much difficulty is experienced in getting any plant to grow on them, and since the surface is constantly shifting, even in cultivation, it has been deemed best to map it as Dunesand.

The material composing Dunesand is of glacial-lacustrine origin, having been laid down under lake waters at the time of the recession of the ice sheet and subsequently drifted.

The native vegetation consists of a sparse growth of such grasses as are able to withstand the low moisture content, a few pines, scrub oaks, and small poplars. The soil has practically no agricultural value.

DRAINAGE.

It will have been noted in reading the descriptions of the several soil types mapped in Genesee County that a considerable proportion of the soils need artificial drainage to insure their highest state of productiveness. Unless thoroughly drained no soil can possibly give maximum yields, and much time, energy, and money are wasted in cultivating inadequately drained soils.

Those areas in need of drainage may be divided into two groups: (1) Swampy or semiswampy depressions, and (2) upland soils that may or may not be under cultivation at present.

The first group includes part of the Meadow areas and the areas of Peat and Muck. In draining these soils it is advisable first to

accomplish what drainage is possible by the use of open ditches. This allows the soil to settle into a more stable and compact structure when underdrainage is more certain of success. During the preliminary period the land may be used for pasture or for cropping. The method of draining Muck and Peat will depend somewhat on the nature of the underlying material and its nearness to the surface.

The second group includes the soils of fine texture and dense structure, especially the clay loams and loams. The coarser textured soils have sufficient natural drainage and are sometimes even excessively drained. A sloping topography does not necessarily mean that a soil is well drained, because the subsoil, especially of the finer textured types, may be of such an impervious character that water does not sink into it readily, resulting in seepage. In Genesee County, however, those soils of comparatively level topography are most in need of artificial drainage.

Artificial drainage not only removes the excessive water from the soil, making it possible to cultivate the soil oftener and with less labor, but it aids in the aeration and allows deeper root penetration.

SUMMARY.

Genesee County, containing 655 square miles, or 419,200 acres, is located southeast of the geographical center of the lower peninsula of Michigan. It may be divided topographically into three general divisions. The northwestern part occupies an old glacial lake bed, the northeastern and southernmost parts are hilly and broken, while the greater part is composed of till plains. The range in elevation within the county is about 225 feet.

All the drainage of the county is through the Flint and Shiawassee Rivers and their tributaries, the Flint River carrying the greater part into Lake Huron.

The first settlers began to arrive in Genesee County about 1830. Flint, a city of about 40,000 people, is at present the industrial center.

The mean annual temperature is about 44° F. The temperature range is from about 93° F. to —26° F. The greatest length of the growing season reported is 173 days and the least 133 days. The mean annual rainfall at Flint is about 28 inches.

Wheat and corn have been prominent crops since the early settlement. Sugar beets are an important special crop.

Agriculture at present consists of general grain and hay farming. Dairy farming is becoming more prominent. Some light soils exist which should be devoted more to truck farming. The growing of alfalfa, special crops, such as cucumbers and tomatoes, and winter apples is advised.

There are 24 types of soils and 5 phases recognized and mapped in this county. These are grouped in 8 series, besides several miscel-

laneous soils. The Miami, Clyde, Coloma, and Fox series occupy most of the county and are most important agriculturally.

The Miami series includes four types and two phases of types, ranging from sandy loam to clay loam. They are characterized by an abundance of limestone in the glacial drift and are relatively calcareous. They cover by far the greater part of the county and constitute the best general purpose soils.

The Miami loam is the most important and widespread soil in the county. A gravelly phase of this type occurs. Production of apples and alfalfa are strongly advised for this soil.

The Miami sandy loam and fine sandy loam are less important but productive soils for general farm crops.

The chief needs of the Miami clay loam are better drainage and deeper plowing.

The Clyde soils are important, and when well drained are very productive.

In the Coloma series are included a fine sandy loam, a light phase of the fine sandy loam, and a loam. This series occupies the area of roughest topography in the county. They should be more extensively devoted to fruit, sheep, and dairy farming. The soils are much in need of lime.

The Fox series includes five types, ranging from gravelly sandy loam to fine sandy loam. They are high river terrace soils.

The soils of the Dunkirk, Plainfield, and Rodman series as encountered in Genesee County are of relatively little importance.

Peat, Muck, and Meadow occupy a considerable area, but are not developed to any extent. They might well be drained and utilized, especially Muck and Peat. Part of the Meadow is essentially nonagricultural. Dunesand in its present state is nonagricultural.

The most important need for soil improvement is underdrainage. Surface ditches are usually inadequate. Shorter and more systematic rotations should be practiced on all the farms, especially on the light soils. A higher grade of commercial fertilizer should be used, if this is used at all. The use of commercial fertilizers should be supplanted, so far as possible, by the use of stable manure, green manures, and by crop rotation. It is necessary to keep up the organic matter in all the upland soils in order to insure the best results. A more systematic rotation should be employed on each farm, one which keeps a field in sod not longer than three years.

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[PUBLIC RESOLUTION—No. 9.]

JOINT RESOLUTION Amending public resolution numbered eight, Fifty-sixth Congress, second session, approved February twenty-third, nineteen hundred and one, "providing for the printing annually of the report on field operations of the Division of Soils, Department of Agriculture."

Resolved by the Senate and House of Representatives of the United States of America in Congress assembled, That public resolution numbered eight, Fifty-sixth Congress, second session, approved February twenty-third, nineteen hundred and one, be amended by striking out all after the resolving clause and inserting in lieu thereof the following:

That there shall be printed ten thousand five hundred copies of the report on field operations of the Division of Soils, Department of Agriculture, of which one thousand five hundred copies shall be for the use of the Senate, three thousand copies for the use of the House of Representatives, and six thousand copies for the use of the Department of Agriculture: *Provided,* That in addition to the number of copies above provided for there shall be printed, as soon as the manuscript can be prepared, with the necessary maps and illustrations to accompany it, a report on each area surveyed, in the form of advance sheets, bound in paper covers, of which five hundred copies shall be for the use of each Senator from the State, two thousand copies for the use of each Representative for the congressional district or districts in which the survey is made, and one thousand copies for the use of the Department of Agriculture.

Approved March 14. 1904.

[On July 1, 1901, the Division of Soils was reorganized as the Bureau of Soils.]

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U. S. DEPT. OF AGRICULTURE
BUREAU OF SOILS
MILTON WHITNEY, CHIEF
CURTIS F MARBUT, IN CHARGE SOIL SURVEY

SOIL MAP

MICHIGAN
GENESEE COUNTY SHEET

SOIL PROFILE (3 feet deep)

- Miami loam — Cl / LI / HI
- Clyde fine sandy loam — Cl / Fsl / Lfs / Fsl
- Miami loam, Gravelly phase — LI / L / HI
- Clyde fine sandy loam, Coarse phase — SI / Ls / SI
- Miami sandy loam — SI / SI
- Clyde loam — Cl / L / HI
- Miami fine sandy loam — L / Fsl / Fsl
- Clyde loam, Light phase — Cl / L / L
- Miami fine sandy loam, Light phase — Lfs / Fsl
- Clyde clay loam — C / Cl
- Miami clay loam — Sicl / Cl / Sicl
- Genesee loam — Sl / L / L
- Fox sand — S / S
- Genesee fine sandy loam — Lfs / Fsl / Fsl
- Fox fine sand — Fs / Fs
- Coloma loam — HI / LI
- Fox sandy loam — Ls / Ls / Ls
- Coloma fine sandy loam — Fsl / Fsl
- Fox gravelly sandy loam — Grs / Grsl / Grsl
- Coloma fine sandy loam, Light phase — Lfs / Fsl
- Fox fine sandy loam — Lfs / Fsl
- Rodman gravelly sandy loam — Grs / Grs / Grsl
- Dunkirk fine sand — Fs / Fs
- Plainfield gravelly sandy loam — Grs / Grs / Grsl
- Dunkirk gravelly sandy loam — Grsl / Grsl

LEGEND

Ll	Light loam
Hl	Heavy loam
Cl	Clay loam
L	Loam
Sl	Sandy loam
Fsl	Fine sandy loam
Lfs	Loamy fine sand
Sicl	Silty clay loam
S	Sand
Fs	Fine sand
Ls	Loamy sand
Grsl	Gravelly sandy loam
Grs	Gravelly sand
C	Clay

LEGEND

- Miami loam — Ml
- Clyde fine sandy loam — Cs
- Miami loam, Gravelly phase — Ml
- Clyde fine sandy loam, Coarse phase — Cs
- Miami sandy loam — Ms
- Clyde loam — C
- Miami fine sandy loam — Mf
- Clyde loam, Light phase — C
- Miami fine sandy loam, Light phase — Mf
- Clyde clay loam — Cc
- Miami clay loam — Mc
- Genesee loam — Gl
- Fox sand — Fs
- Genesee fine sandy loam — Gf
- Fox fine sand — Ff
- Coloma loam — Cl
- Fox sandy loam — Fl
- Coloma fine sandy loam — Cf
- Fox gravelly sandy loam — Fg
- Coloma fine sandy loam, Light phase — Cf
- Fox fine sandy loam — F
- Rodman gravelly sandy loam — Rg
- Dunkirk fine sand — Df
- Plainfield gravelly sandy loam — Pg
- Dunkirk gravelly sandy loam — Dg
- Peat — P
- Muck — Mu
- Dunesand — D
- Meadow — M

J. E. Lapham, Inspector in Charge Northern Division
Soils surveyed by B. D. Gilbert.

Scale 1 inch = 1 mile (1 ½ 0 1 2 3 4 Miles)

A. Hoen & Co. Lith. Balto. Md.

Field Operations
Bureau of Soils
1912